MEMORANDUM

TO: Al Nielsen/Brenda Tarplee   cc: 3385.101 file

FROM: Tom Brennan/Pat Wood/Tim Leighton/Jeff Dawson

DATE: January 29, 1997

SUBJECT: Summary Review of Evaluation of Worker Exposure to Tribufos During Harvesting of Cotton Treated with DEF 6

A study was submitted in support of the registration requirements for Tribufos formulated as DEF 6, an emulsifiable product containing 70.5 percent by weight (6 pounds per gallons) of the active ingredient. This study was submitted to satisfy the requirements specified by the U.S. Environmental Protection Agency (i.e. the Agency) under Subdivision K (Exposure: Re-entry Protection) of the Pesticide Assessment Guidelines as stipulated in the 1988 FIFRA reauthorization (U.S. EPA, 1984/U.S. EPA 1988). This study's identifying information is presented below:

Table 1: Identifying Information

Title:	Evaluation of Worker Exposure to Tribufos During Harvesting of Cotton Treated with DEF 6.
Testing Facility:	Miles Inc. Agricultural Division Research and Development Department 8400 Hawthorn Road Kansas City, Missouri 64120-0013
Authors:	D.C. Eberhart and G.K. Ellisor
Date:	March 15, 1993
MRID No.:	427016-01

DEF 6 (Tribufos) is a defoliant widely used in the U.S. on cotton. It is used to accelerate the defoliation process for a clean fast leaf drop and allows efficient mechanical harvesting. The purpose of this study was to determine the dermal and inhalation exposures

and to monitor the blood cholinesterase activity of *picker operators, module builder operators, rakers, and trampers* as they conduction their designated activities in DEF 6 treated cotton fields. In addition, this study was used "to compare dermal exposure and dislodgeable residue data to calculate a dermal transfer coefficient for each job category".

Application Parameters

DEF 6 was applied to each field at a maximum proposed label rate of 2.5 pints/acre (equal to 1.9 lbs ai/acre). For the reentry exposure portion of the study, 2 sites in the San Joaquin Valley, CA were used. For the dislodgeable foliar residue (DFR) portion of the study, 2 residue trials were conducted in Mississippi and 2 were conducted in California. Both the dermal monitoring and the foliar (i.e., cotton boll) residue portion of the study were conducted in September and October of 1991. DEF 6 was applied using either aerial equipment or power-operated ground spray equipment. "The aerially-treated field was harvested utilizing the module harvesting system on Days 15 and 17 post-application. The ground-treated field was harvested utilizing the trailer-harvesting system on Day 20 post-application."

DEF 6 was applied aerially using two Ayers Corporation S2R-600 airplanes equipped with a 400 gallon tank, 62 nozzles and a 52 foot swath width. The spray pressure was 48 psi. Ground applications were made using two John Deere Hy-Cycle sprayers mounted with a wet boom and 63 drop nozzles. Other parameters included a swath width of 30 feet, a sprayer speed of 9 mph, and a spray pressure of 45 psi.

The DFR study in California was conducted in the same fields that were harvested for the exposure portion of the study. Both fields in California were treated at the maximum proposed rate of 2.5 pints/acre. One field was treated by air and the other by ground spray. In Mississippi, the first trial was a single application of 2.5 pints/acre. The second trial was a single application of 1 pint/acre and a second application of 1.5 pints/acre to the same plot 7 days later. Aerial applications were used for both of the Mississippi trials.

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Climatological Conditions

According to the registrant there were "typical" weather conditions from application to harvest at the California sites. Weather data were obtained from weather stations located approximately 9 miles from the trailer harvested field and approximately 14 miles from the module harvested field. Daily environmental conditions were presented for the test sites. The average temperature ranged from 77° to 89° F during harvesting. The wind speed ranged from 4.0 to 5.6 mph. Weather data were collected from CIMIS Weather Station #2 in Five Points, California.

For the Mississippi site, the average temperature ranged from 53° to 78° F for the 30 day study period. The total rainfall during the study period was 3.38 inches. The climatological data were collected from the USDA Southern Research Laboratory in Stoneville, Mississippi.

Exposure Monitoring

In California, workers were monitored for dermal and inhalation exposure; blood cholinesterase activity was also evaluated. DFR sampling (i.e., cotton bolls) was conducted in both California and Mississippi (two trials in each state).

For inhalation and dermal exposure monitoring, the workers were equipped with all monitoring equipment at the beginning of each replicate. Each replicate duration consisted of the amount worked in half-day cycles. A total of 30 dermal and inhalation exposure replicates were collected in California. Replicates monitored are as follows: 10 for picker operators (PO), 10 for rakers (RK), 6 for module builder operators (MBO), and 4 for trampers (TR). According to the registrant, the specific activities of the module builder operator and the tamper are different, but their function in the terms of harvesting cotton is the same. Therefore, 10 replicates were collected to represent each major work function.

Dermal exposures were monitored using gauze patch dosimeters (3" x 3" cotton patches), whole body dosimetry (a long-sleeved cotton or cotton/synthetic blend tee-shirt and

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a pair of white cotton or cotton/synthetic blend tights), and solvent hand rinse. Each worker wore cotton/polyester coveralls over the whole body dosimeters and a baseball cap. For the patch dosimetry, the gauze pads (wrapped in aluminum envelopes with a 24.6 cm² exposed area) were attached outside to the workers chest, back, front of cap, and the inside of both forearms. Dosimeter garments were removed from the test subject and placed in separate resealable plastic bags. Gauze pads were removed from foil envelopes and placed in 1-oz bottles with polyseal caps. Hand washes from each replicate were collected by washing each hand twice (in separate containers) in 200 ml of absolute ethanol. The composite of the two hand washes were placed in polyseal capped bottles.

Inhalation exposures were monitored using personal air sampling within the breathing zone (attached to the worker's collar). The pumps were attached to an OVSD-2 tube with a glass fiber filter with XAD-2 resin. Pumps were calibrated before and after each sampling period.

Cholinesterase activity was monitored through blood sampling. "The erythrocyte and plasma cholinesterase activity of 5 picker operators, 5 module builder operators/trampers and 5 rakers was monitored on a weekly basis for a 5-6 week period."

Dislodgeable residues were measured by collecting cotton bolls (tribufos is a defoliant). Cotton boll samples were collected 0, 1, 2, 4, 7 through 13, 15 and 17 days after treatment (DAT) in California for the aerially treated field. For the field in California sprayed by ground equipment, samples were taken on 0, 1, 2, 4, 7 through 13, 15, 16, 17, 18 and 20 DAT. In Mississippi, samples were taken on 0, 1, 2, 4, 7 through 17 DAT for trial 1. For trial 2, samples were taken prior to initial application and on 0, 1, 2, 4, and 7 through 14 DAT. For the DFR sample collection, each treated plot was divided into 3 subplots. At each sampling interval, one sample was collected from each subplot totaling 3 samples/interval/site. Cotton bolls were randomly selected, alternating from upper, middle, and lower parts of the plant to obtain a 50 g sample. The cotton bolls were then immersed in 200ml of Nekal/water solution, shaken, squeezed and decanted in a sample container.

Field fortified samples were prepared on 1 and 7 DAT in California and on 7 DAT in Mississippi.

Analytical Method

All samples were analyzed using a gas chromatograph with nitrogen-phosphorus detector and peak areas of the samples were compared with the areas of standards with known concentrations. A method validation was performed for each sampling media. The detection limits for analysis of each matrix were as follows:

- gauze pads $= 0.075$ μg/sample;
- whole body dosimeters $= 5$ μg/sample upper body and 3 μg/sample lower body;
- hand rinse $= 1$ μg/sample;
- air $= 50$ ng/sample; and
- DFR (cotton bolls) $= 1$ μg/sample.

The results for the storage stability experiments for all the matrices are presented in Table 2. Laboratory and field fortification levels and average (or range) of recoveries for each matrix are listed in Table 3.

Table 2. Storage Stability Recoveries

Matrix	Spike (μg)	Number	Days Stored	Recoveries (%)
Gauze Pads	1.0	49	0 to 215	90.9 to 99.1
Hand Rinse*	5.0	49	0 to 131	58.0 to 120
Full Body Dosimeters	10.0	49	0 to 179	94.1 to 111
Air	5.0	49	0 to 173	97.7 to 99.3
DFR	101.3	49	0 to 112	83.2 to 94.1

* Simulation of handrinses (DEF 6 in ethanol).

Table 3. Laboratory and Field Recoveries

Fortification Level (μg)	Number of Samples	Average/Range Recovery (%)
Field Fortifications of Gauze Pads		
0.1	14	64 to 71
1.0	28	67.8 to 105
10.0	21	82.4 to 91.7
100.0	14	80.5 to 91.3
1000.0	7	85.8
Laboratory Fortifications of Gauze Pads		
0.1	7	83.8
0.6	7	93.7
1.0	7	96.8
Field Fortifications of Handrinses		
0.025	14	81.5 to 101
0.5	7	109
5.0	7	97.6
Laboratory Fortifications of Handrinses		
0.025	7	108
Field Fortification of Full Body Dosimeters		
10	14	103 to 116
100	7	107
1000	7	102
Laboratory Fortifications of Full Body Dosimeters		
10000	7	97.7
Field Fortifications of Air Samples		
5.0	15	76.1 to 83.3
Laboratory Fortifications of Air Samples		
5.0	7	99.9
Laboratory Fortifications for DFR Samples		
130	14	80.0 to 87.6
3000	6	61.2 to 81.9
10000	10	77.2 to 79.8

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Study Results

The study results show that trampers had the highest total exposure to tribufos with a total geometric mean exposure of 179.73 μg/hr. Geometric mean total exposures include 141.83 μg/hr for picker operators, 87.99 μg/hr for rakers, and 43.64 μg/hr for module builder operators. The individual replicate results and geometric means for each work category are presented in Table 4. This table portrays both dermal and inhalation exposures.

DFR data from the Mississippi and California sites were analyzed by Versar using QuatroPro 1.0. Appendix A contains a detailed summary of the dissipation data. Table 5 summaries the best fit mean DFR data (corrected for field recovery if less than 90 percent) for all four sites and an overall average. Table 6 presents the Versar calculated Tc (50 g/hr) for each activity using both the actual and predicted DFR values. Table 6 also provides the study site locations, sampling intervals, actual and predicted DFRs, and dermal exposure for each of the four activities monitored. Exposures were not calculated for the predicted days 0 to 30 because Versar needs EPA's input on which Tc values to use.

"A review of the individual and group mean cholinesterase monitoring results for workers in each job category indicates that all post-exposure cholinesterase values were within acceptable limits. None of the workers had to removed from exposure due to a significant cholinesterase depression (erythrocyte cholinesterase value, 70% of baseline) as required by the study protocol and CDPR regulations."

Table 4. Tribufos Dermal and Inhalation Exposures for Picker Operators, Module Builder Operators, Rakers, and Trampers[a]

Replicate (b)	DAT	Dermal Exposure (μg/hr)[c]				Inhalation Exposure (μg/hr)			
		Pickers	Module	Rakers	Trampers	Pickers	Module	Rakers	Trampers
1	15	118	72	123	NA	9	13	14	NA
2	15	89	120	184	NA	3	8	12	NA
3	15	49	46	83	NA	13	5	3	NA
1	20	169	NA	65	61	5	NA	2	3
3	20	243	NA	59	83	3	NA	4	5
2	20	205	NA	156	440	3	NA	7	11
4	20	234	NA	133	401	4	NA	8	14
4	17	165	20	80	NA	4	1	3	NA
5	17	154	22	54	NA	3	6	2	NA
6	17	92	20	26	NA	5	3	2	NA
Geometric Mean		137	39	84	173	5	5	4	7
STD		1.7	2.2	1.8	2.8	1.6	2.4	2	2

DAT - Days after treatment.
NA - not available.

[a]   Passive dosimetry monitoring data were collected at the California sites (DAT 15 and 17 are from the aerially treated field and DAT 20 is from the ground-treated field).

[b]   Replicate refers to the study defined replicates for reviewers to match these results to the original study. Five different individuals were used for the pickers, 3 for the module builder operators, 6 for the rakers, and 2 for the trampers.

[c]   The dermal exposure represents workers wearing cotton/polyester coveralls over the whole body dosimeters.

Table 5. Best Fit DFR Data for Mississippi and California Sites.

LINEAR REGRESSION DATA				
	CA GROUND	CA AERIAL	MS GROUND 1	MS GROUND 2
CONSTANT	4.513567	4.484742	3.80721	4.347296
X COEFF.	-0.194679	-0.255212	-0.260666	-0.363737
CORR. COEF.	0.941	0.882	0.881	0.964

SAMPLING INTERVAL (DAYS)	PREDICTED DFR VALUES (ug/50 g COTTON)				PREDICTED FOR ALL SITES		
	CA GROUND	CA AERIAL	MS GROUND 1	MS GROUND 2	MEAN	STD. DEV.	C.V.
0	91.2467	88.6541	45.0246	77.2692	75.5487	18.39	24.34
1	75.1051	68.6849	34.6932	53.7078	58.0478	15.56	26.80
2	61.8189	53.2138	26.7324	37.3309	44.7740	13.63	30.43
3	50.8831	41.2275	20.5984	25.9478	34.6642	12.04	34.74
4	41.8818	31.9411	15.8718	18.0356	26.9326	10.61	39.38
5	34.4728	24.7464	12.2299	12.5361	20.9963	9.28	44.17
6	28.3746	19.1724	9.4236	8.7135	16.4210	8.04	48.99
7	23.3551	14.8538	7.2612	6.0565	12.8817	6.92	53.75
8	19.2235	11.5080	5.5950	4.2097	10.1341	5.92	58.42
9	15.8229	8.9159	4.3112	2.9261	7.9940	5.03	62.98
10	13.0238	6.9076	3.3219	2.0338	6.3218	4.26	67.41
11	10.7199	5.3517	2.5597	1.4137	5.0112	3.59	71.71
12	8.8235	4.1462	1.9723	0.9826	3.9812	3.02	75.88
13	7.2626	3.2123	1.5198	0.6830	3.1694	2.53	79.91
14	5.9779	2.4887	1.1710	0.4747	2.5281	2.12	83.82
15	4.9204	1.9282	0.9023	0.3300	2.0202	1.77	87.60
16	4.0499	1.4938	0.6953	0.2294	1.6171	1.48	91.25
17	3.3335	1.1574	0.5357	0.1594	1.2965	1.23	94.78
18	2.7438	0.8967	0.4128	0.1108	1.0410	1.02	98.20
19	2.2584	0.6947	0.3181	0.0770	0.8371	0.85	101.50
20	1.8589	0.5382	0.2451	0.0535	0.6739	0.71	104.70
21	1.5301	0.4170	0.1889	0.0372	0.5433	0.59	107.78
22	1.2594	0.3231	0.1455	0.0259	0.4385	0.49	110.76
23	1.0366	0.2503	0.1121	0.0180	0.3543	0.40	113.63
24	0.8532	0.1939	0.0864	0.0125	0.2865	0.33	116.40
25	0.7023	0.1502	0.0666	0.0087	0.2319	0.28	119.07
26	0.5781	0.1164	0.0513	0.0060	0.1879	0.23	121.64
27	0.4758	0.0902	0.0395	0.0042	0.1524	0.19	124.12
28	0.3916	0.0699	0.0305	0.0029	0.1237	0.16	126.50
29	0.3223	0.0541	0.0235	0.0020	0.1005	0.13	128.78
30	0.2653	0.0419	0.0181	0.0014	0.0817	0.11	130.98

(e ^ ((X COEFFICIENT * INTERVAL (days)) + CONSTANT))

Table 6. Calculated Tc (50 g/hr) for Picker Operators, Module Builder Operators, Rakers, and Trampers Using Actual and Predicted DFR Data.

STUDY SITE	SAMPLE INTERVAL (DAT)	ACTUAL DFR (ug/50 g)	PREDICTED DFR (ug/50 g)	AVERAGE DERMAL EXPOSURES BY JOB FUNCTION (ug/hr)			
				PICKERS	MODULE	RAKERS	TRAMPERS
CA AERIAL	15	2.38	1.93	85.33	79.33	130.00	NO DATA
CA AERIAL	17	6.08	1.16	137.00	NO DATA	413.00	246.25
CA GROUND	20	2.78	1.86	212.75	20.67	53.33	NO DATA

STUDY SITE	SAMPLE INTERVAL (DAT)	TRANSFER COEFFICIENTS USING ACTUAL DFR (50 g/hr)			
		PICKERS	MODULE	RAKERS	TRAMPERS
CA AERIAL	15	35.85	33.33	54.62	NO DATA
CA AERIAL	17	22.53	NO DATA	67.93	40.50
CA GROUND	20	76.53	7.44	19.18	NO DATA
	MEAN	44.97	20.38	47.24	N/A

STUDY SITE	SAMPLE INTERVAL (DAT)	TRANSFER COEFFICIENTS USING PREDICTED DFR (50 g/hr)			
		PICKERS	MODULE	RAKERS	TRAMPERS
CA AERIAL	15	44.25	41.14	67.42	NO DATA
CA AERIAL	17	118.37	NO DATA	356.83	212.76
CA GROUND	20	114.44	11.12	28.69	NO DATA
	MEAN	92.36	26.13	150.98	N/A

TRANSFER COEFFICIENT CALCULATED USING: EXPOSURE (ug/hr)/DFR (ug/50 g COTTON)

QA/QC SUMMARY

Compliance with Sections 132 and 133 of Subdivision K of the Pesticide Assessment Guidelines (U.S. EPA, 1984) is critical. The itemized lists below describe compliance with the major technical aspects of Subdivision K. The lists are based on the "Checklist for Post-Application Human Exposure Data" and the "Checklist for Residue Dissipation Data" used for study reviews by the U.S. EPA/OPP/OREB. The individual checklists have been combined wherever appropriate and/or redundant.

- *Typical end use product of the active ingredient used.* This criterion was met. DEF 6 was applied to commercial cotton fields with both aerial and ground spraying equipment.

- *Site(s) tested representative of reasonable worst-case climatic conditions expected in intended use areas.* This criterion was met. The use of Mississippi and California as test sites gave a good representation of climatic conditions for where cotton is grown in the United States.

- *End-use product applied by application method recommended for the crop. Application rate given and should be at least dilution and highest, label permitted, application rate.* This criterion was met. The application rate used, 1.9 ai/acre, was the maximum rate allowable by the label (EPA Reg. No 3125-282). The application methods were also consistent with the label specifications. DEF 6 was applied using either aerial equipment or power-operated ground spray equipment.

- *Application(s) occurred at time of season that the end-use product is normally applied to achieve intended pest control.* This criterion was met. In the case of DEF 6 pest control is not the goal, instead this growth regulator is used as a defoliant of cotton prior to harvest. This study was conducted in early fall just before harvest.

- *Each sampling period should use at least 10 workers.* This criterion was met. A total of 30 replicates were collected, 10 from each of 3 plots (i.e., 10 replicates of picker operators, 10 replicates of rakers, and a combination of 6 module builder operators and 4 trampers).

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- *Meteorological conditions including temperature, wind speed, daily rainfall, and humidity provided for the duration of the study.* This criterion was met. Appropriate climatic data were collected during the application and foliar dislodgeable residue portions of this study.

- *Dermal and/or inhalation exposure must be monitored by validated methodologies. Biological monitoring is consistent with and supported by pharmacokinetics data accepted by the Agency.* This criterion was met. Dermal exposure was monitored with a cotton\synthetic blend whole-body dosimeters (Tee-shirt and leg tights), used in conjunction with gauze patches and hand rinses. Inhalation monitoring was conducted with personal air pumps connected to OVSD-2 tube with glass fiber filter with XAD-2 resin. Cholinesterase monitoring was conducted during this study by testing blood samples drawn from the workers.

- *Clothing worn by each study participant and location of dosimeters reported.* This criterion was met. Gauze patch dosimeters were worn outside the workers' clothing. In addition, the workers wore cotton/synthetic blend whole-body dosimeters. In addition to the whole body dosimeters, each worker wore cotton/polyester coveralls over the whole body dosimeters and baseball caps.

- *Duplicate foliar and/or soil samples collected at each collection period.* This criterion was met as triplicate cotton bolls were collected during each collection period.

- *Sufficient collection times to establish dissipation curve. First sample time taken as soon as sprays dry or dusts settle. Short durations should exist between earlier sample intervals and may lengthen with later samples.* This criterion was met. At the California site where aerial application equipment was used, residue samples were taken on days 0 (after sprays have dried), 1, 2, 4, 7 to 13, 15 and 17. At the California site where ground application equipment was used, residue samples were taken on days 0 (after sprays have dried), 1, 2, 4, 7 to 13, 15, 16, 18 and 20. At the Mississippi site (trial 1) residue samples were taken on days 0 (after sprays have dried), 1, 2, 4, and 7 to 17. At the Mississippi site

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(trial 2) residue samples were taken on days 0 (after sprays have dried), 1, 2, 4 and 7 to 14.

- *Control and baseline foliar or soil samples collected.* This criterion was met. Control cotton boll samples were collected before the first application in each field. These controls served as blanks and were stored and shipped with the field dislodgeable residue samples.

- *Residue storage stability, method efficiency (residue recovery), and limit of quantification provided.* This criterion was met. Storage stability data were evaluated concurrently with study sample freezer storage. The LODs were as follows: gauze pads 0.075 μg/sample, upper whole-body dosimeters 5 ug/sample, lower whole-body dosimeters 3 ug/sample, hand rinses 1 ug/sample, air samples 50 ng/sample, and DFR samples 1 ug/sample.

- *Efficiency of extraction in laboratory provided as means plus or minus one standard deviation. Lower 95 percent confidence limits not less than 70 percent based on a minimum of seven replicates per fortification level prior Agency approval of extraction methodology provided.* This criterion was met. Table 3 presents the recovery results. Except for one fortification level, where only 6 samples were analyzed (3,000 ug) for DFR samples, all other fortification levels had at least 7 samples. All the average recoveries were greater than 70 percent.

- *Foliar residue data expressed as ug or μg/cm^2 leaf surface area.* This criterion was met. The residue data for *cotton bolls* was expressed in μg/50 g sample.

- *Reported residue dissipation data in conjunction with toxicity data must be sufficient to support the determination of a re-entry interval.* This criterion was not met. No toxicity data were supplied in this report, and as a result no reentry interval can be established. However, it was possible to calculate the transfer coefficient for the plots where worker reentry was monitored.

SUMMARY

No major deficiencies were noted in the tribufos reentry exposure study when compared to Subdivision K of the Pesticide Assessment Guidelines (U.S. EPA, 1984/U.S. EPA 1988). The representativeness of the individual or average transfer coefficients cannot be determined by Versar because transfer coefficients for cotton harvesting are atypical. Additionally, EPA needs to decide which of the transfer coefficients is appropriate to use in the upcoming Reregistration Eligibility Decision Document (RED).

APPENDIX A

DETECTION LIMIT (ug/50 G COTTON):	1.1
CORRECTION FACTOR (%) CA GROU	75.8
CORRECTION FACTOR (%) CA AERIAL	90.4
CORRECTION FACTOR (%) MI SITE 1:	101.0
CORRECTION FACTOR (%) MI SITE 2:	88.6

SAMPLE MATRIX. COTTON BOLL DISLODGING SOLUTIONS (50 g COTTON BOLLS WASHED IN 200 mL NEKAL WT27 IN WATER, 0.01%)
SAMPLES COLLECTED AT SITES IN CALIFORNIA (CA) AND IN MISSISSIPPI (MISS)
ALL RESIDUE LEVELS CORRECTED AS APPROPRIATE FOR CORRESPONDING RECOVERY FACTOR AS FIELD RECOVERY APPEARS IMPACTED BY CONCENTRATIONS

RECOVERY DATA SUMMARY. ALL FORTIFICATION LEVELS

TYPE	N	FORT LEVEL (ug)	RECOVERY (%) MEAN VALUE	STD DEV	COMMENTS
METHOD VALIDATI	30	130 TO 10000	79.6	2.2 TO 16.7	
STOR H2O (112 DA	7	101.3	84.9	5.1	
EXT STOR (14 DA	1	0.02082 ug/mL	105.0	N/A	CONCENTRATED EXTRACT STORAGE STABILITY
FR GROUND CA	19	201 TO 10050	61.1	21.4	DATA CORRECTED FOR LOW LEVEL RECOVERY AS MEAN RECOVERY = 75.8 %
FR AERIAL CA	8	201 TO 10050	76.9	14.9	DATA NOT CORRECTED FOR LOW LEVEL RECOVERY AS MEAN RECOVERY = 90.4 %
FR MISS SITE 1	6	213.2 TO 10750	65.8	38.6	DATA NOT CORRECTED FOR LOW LEVEL RECOVERY AS MEAN RECOVERY =101.0%
FR MISS SITE 2	6	213.2 TO 10750	62.0	29.4	DATA CORRECTED FOR LOW LEVEL RECOVERY AS MEAN RECOVERY = 88.6 %

UNLESS NOTED ALL VALUES ARE (ug), FR IS FIELD RECOVERY
STANDARD DEVIATION VALUES PRESENTED FOR EACH FORTIFICATION LEVEL
MISS SITE 1 = 1 GROUND APPLICATION, MISS SITE 2 = 2 GROUND APPLICATIONS

NON CORRECTED TRIBUFOS LEVELS (ug/50 g COTTON IN 200 mL WASH SOLUTION) — DAYS AFTER APPLICATION

SITE	0	1	2	4	7	8	9	10	11	12	13	15	16	17	18	20
CA GROUND SPRA																
R1	206.40	83.84	31.04	21.32	8.97	14.94	9.03	6.90	3.91	8.70	7.66	4.33	2.62	2.53	4.59	3.39
R2	115.44	121.20	70.39	18.18	10.71	18.23	3.27	3.15	7.20	4.76	4.91	2.50	1.63	2.75	2.73	1.59
R3	122.97	89.86	33.02	25.07	23.58	12.67	6.53	5.87	4.38	3.96	7.54	3.91	2.41	5.44	3.67	1.35
CA AERIAL SPRAY	0	1	2	4	7	8	9	10	11	12	13	15	17			
R1	96.81	97.14	67.55	70.06	4.52	4.82	7.81	8.17	ND	3.48	3.52	1.66	9.38			
R2	119.72	133.33	42.03	68.83	13.71	7.54	8.00	8.39	1.69	2.11	2.69	1.38	3.18			
R3	103.64	124.36	78.92	50.06	13.54	7.00	4.16	1.89	1.75	1.36	2.15	4.10	5.70			
MISS SITE 1	0	1	2	4	7	8	9	11	13	14	17					
R1	216.54	144.52	34.89	13.25	1.26	1.90	3.93	ND	1.25	ND	ND					
R2	52.58	74.85	22.80	12.83	2.90	1.84	ND	3.33	2.48	1.71	ND					
R3	52.31	35.59	26.87	4.94	4.39	3.74	1.07	3.82	ND	ND	6.00					
MISS SITE 2	0	1	2	4	7	8	9	10								
R1	73.62	60.00	22.35	10.64	4.05	1.76	4.47	1.96								
R2	109.23	49.33	39.44	16.64	3.44	1.80	3.37	2.49								
R3	80.29	50.54	31.39	13.78	2.41	2.83	5.15	3.54								

CORRECTED TRIBUFOS LEVELS (ug/50 g COTTON IN 200 mL WASH SOLUTION) — DAYS AFTER APPLICATION

SITE	0	1	2	4	7	8	9	10	11	12	13	15	16	17	18	20
CA GROUND SPRA																
R1	272.30	110.61	40.95	28.12	11.84	19.71	11.91	9.11	5.15	11.48	10.11	5.72	3.45	3.34	6.06	4.48
R2	152.30	159.89	92.86	23.99	14.13	24.05	4.31	4.16	9.50	6.28	6.48	3.29	2.15	3.63	3.60	2.10
R3	162.23	118.55	43.56	33.07	31.11	16.72	8.61	7.74	5.77	5.22	9.94	5.16	3.18	7.17	4.84	1.78
MEAN	195.61	129.68	59.12	28.39	19.03	20.16	8.28	7.00	6.81	7.66	8.84	4.72	2.93	4.71	4.83	2.78
LN(MEAN)	5.28	4.87	4.08	3.35	2.95	3.00	2.11	1.95	1.92	2.04	2.18	1.55	1.07	1.55	1.58	1.02
CA AERIAL SPRAY	0	1	2	4	7	8	9	10	11	12	13	15	17			
R1	96.81	97.14	67.55	70.06	4.52	4.82	7.81	8.17	0.55	3.48	3.52	1.66	9.38			
R2	119.72	133.33	42.03	68.83	13.71	7.54	8.00	8.39	1.69	2.11	2.69	1.38	3.18			
R3	103.64	124.36	78.92	50.06	13.54	7.00	4.16	1.89	1.75	1.36	2.15	4.10	5.70			
MEAN	106.72	118.28	62.83	62.99	10.59	6.45	6.66	6.15	1.33	2.31	2.79	2.38	6.08			
LN(MEAN)	4.67	4.77	4.14	4.14	2.36	1.86	1.90	1.82	0.28	0.84	1.03	0.87	1.81			
MISS SITE 1	0	1	2	4	7	8	9	11	13	14	17					
R1	216.54	144.52	34.89	13.25	1.26	1.90	3.93	0.55	1.25	0.55	0.55					
R2	52.58	74.85	22.80	12.83	2.90	1.84	0.55	3.33	2.48	1.71	0.55					
R3	52.31	35.59	26.87	4.94	4.39	3.74	1.07	3.82	0.55	0.55	6.00					
MEAN	107.14	84.98	28.19	10.34	2.85	2.49	1.85	2.57	1.43	0.94	2.37					
LN(MEAN)	4.67	4.44	3.34	2.34	1.05	0.91	0.62	0.94	0.35	-0.06	0.86					
MISS SITE 2	0	1	2	4	7	8	9	10								
R1	83.09	67.72	25.23	12.01	4.58	1.99	5.04	2.21								
R2	123.29	55.68	44.52	18.78	3.88	2.03	3.80	2.81								
R3	90.63	57.04	35.43	15.55	2.72	3.20	5.81	3.99								
MEAN	99.00	60.15	35.06	15.45	3.73	2.40	4.88	3.01								
LN(MEAN)	4.60	4.10	3.56	2.74	1.32	0.88	1.59	1.10								

TRIBUPHOS ON COTTON/EXPOSURE AND DFR DATA
VERSAR, INC.
JLD 6/13/96
SAMPLE MATRIX: COTTON BOLLS WASHED IN DISLODGING SOLUTION
SAMPLES COLLECTED AT SITES IN CALIFORNIA (CA) AND IN MISSISSIPPI (MISS)
RESIDUE LEVELS CORRECTED FOR FIELD RECOVERY AS APPROPRIATE
DATA SOURCE: CALIFORNIA GROUND APPLICATION

STUDY DAY	TRIBUPHOS RESIDUE LEVELS (ug/50g)				
	REP 1	REP 2	REP 3	MEAN	Ln(MEAN)
0	272.30	152.30	162.23	195.61	5.28
1	110.61	159.89	118.55	129.68	4.87
2	40.95	92.86	43.56	59.12	4.08
4	28.12	23.99	33.07	28.39	3.35
7	11.84	14.13	31.11	19.03	2.95
8	19.71	24.05	16.72	20.16	3.00
9	11.91	4.31	8.61	8.28	2.11
10	9.11	4.16	7.74	7.00	1.95
11	5.15	9.50	5.77	6.81	1.92
12	11.48	6.28	5.22	7.66	2.04
13	10.11	6.48	9.94	8.84	2.18
15	5.72	3.29	5.16	4.72	1.55
16	3.45	2.15	3.18	2.93	1.07
17	3.34	3.63	7.17	4.71	1.55
18	6.06	3.60	4.84	4.83	1.58
20	4.48	2.10	1.78	2.78	1.02

SEMILOG LINEAR REGRESSION USING MEAN VALUES AT EACH INTERVAL
         Regression Output:

Constant		4.513567
Std Err of Y Est		0.451769
R Squared		0.885394
No. of Observations		16
Degrees of Freedom		14
Correlation Coefficient		0.940954
X Coefficient(s)	-0.194679	
Std Err of Coef.	0.018719	

TRIBUPHOS ON COTTON/EXPOSURE AND DFR DATA
VERSAR, INC.
 JLD 6/13/96
SAMPLE MATRIX: COTTON BOLLS WASHED IN DISLODGING SOLUTION
SAMPLES COLLECTED AT SITES IN CALIFORNIA (CA) AND IN MISSISSIPPI (MISS)
RESIDUE LEVELS CORRECTED FOR FIELD RECOVERY AS APPROPRIATE
DATA SOURCE: CALIFORNIA AERIAL APPLICATION

| STUDY | TRIBUPHOS RESIDUE LEVELS (ug/50g) | | | | |
DAY	REP 1	REP 2	REP 3	MEAN	Ln(MEAN)
0	96.81	119.72	103.64	106.72	4.67
1	97.14	133.33	124.36	118.28	4.77
2	67.55	42.03	78.92	62.83	4.14
4	70.06	68.83	50.06	62.99	4.14
7	4.52	13.71	13.54	10.59	2.36
8	4.82	7.54	7.00	6.45	1.86
9	7.81	8.00	4.16	6.66	1.90
10	8.17	8.39	1.89	6.15	1.82
11	0.55	1.69	1.75	1.33	0.28
12	3.48	2.11	1.36	2.31	0.84
13	3.52	2.69	2.15	2.79	1.03
15	1.66	1.38	4.10	2.38	0.87
17	9.38	3.18	5.70	6.08	1.81

SEMILOG LINEAR REGRESSION USING MEAN VALUES AT EACH INTERVAL

                Regression Output:
Constant   4.484742
Std Err of Y Est   0.766837
R Squared   0.778516
No. of Observations   13
Degrees of Freedom   11
Correlation Coefficient   0.882336
X Coefficient(s)   -0.255212
Std Err of Coef.   0.041043

TRIBUPHOS ON COTTON/EXPOSURE AND DFR DATA
VERSAR, INC.
JLD 6/13/96
SAMPLE MATRIX: COTTON BOLLS WASHED IN DISLODGING SOLUTION
SAMPLES COLLECTED AT SITES IN CALIFORNIA (CA) AND IN MISSISSIPPI (MISS)
RESIDUE LEVELS CORRECTED FOR FIELD RECOVERY AS APPROPRIATE
DATA SOURCE: MISSISSIPPI GROUND APPLICATION (SITE 1)

| STUDY | TRIBUPHOS RESIDUE LEVELS (ug/50g) | | | | |
DAY	REP 1	REP 2	REP 3	MEAN	Ln(MEAN)
0	216.54	52.58	52.31	107.14	4.67
1	144.52	74.85	35.59	84.98	4.44
2	34.89	22.80	26.87	28.19	3.34
4	13.25	12.83	4.94	10.34	2.34
7	1.26	2.90	4.39	2.85	1.05
8	1.90	1.84	3.74	2.49	0.91
9	3.93	0.55	1.07	1.85	0.62
11	0.55	3.33	3.82	2.57	0.94
13	1.25	2.48	0.55	1.43	0.35
14	0.55	1.71	0.55	0.94	-0.06
17	0.55	0.55	6.00	2.37	0.86

SEMILOG LINEAR REGRESSION USING MEAN VALUES AT EACH INTERVAL

Regression Output:

Constant	3.807210
Std Err of Y Est	0.832857
R Squared	0.775640
No. of Observations	11
Degrees of Freedom	9
Correlation Coefficient	0.880704
X Coefficient(s)	-0.260666
Std Err of Coef.	0.046731

TRIBUPHOS ON COTTON/EXPOSURE AND DFR DATA
VERSAR, INC.
JLD 6/13/96
SAMPLE MATRIX: COTTON BOLLS WASHED IN DISLODGING SOLUTION
SAMPLES COLLECTED AT SITES IN CALIFORNIA (CA) AND IN MISSISSIPPI (MISS)
RESIDUE LEVELS CORRECTED FOR FIELD RECOVERY AS APPROPRIATE
DATA SOURCE: MISSISSIPPI GROUND APPLICATION (SITE 2)

STUDY	TRIBUPHOS RESIDUE LEVELS (ug/50g)				
DAY	REP 1	REP 2	REP 3	MEAN	Ln(MEAN)
0	83.09	123.29	90.63	99.00	4.60
1	67.72	55.68	57.04	60.15	4.10
2	25.23	44.52	35.43	35.06	3.56
4	12.01	18.78	15.55	15.45	2.74
7	4.58	3.88	2.72	3.73	1.32
8	1.99	2.03	3.20	2.40	0.88
9	5.04	3.80	5.81	4.88	1.59
10	2.21	2.81	3.99	3.01	1.10

SEMILOG LINEAR REGRESSION USING MEAN VALUES AT EACH INTERVAL

Regression Output:

Constant		4.347296
Std Err of Y Est		0.421747
R Squared		0.928579
No. of Observations		8
Degrees of Freedom		6
Correlation Coefficient		0.963628
X Coefficient(s)	-0.363737	
Std Err of Coef.	0.041183	

TRIBUPHOS ON COTTON/EXPOSURE AND DFR DATA
VERSAR, INC.
 JLD 6/13/96
SAMPLE MATRIX: COTTON BOLLS WASHED IN DISLODGING SOLUTION
SAMPLES COLLECTED AT SITES IN CALIFORNIA (CA) AND IN MISSISSIPPI (MISS)
RESIDUE LEVELS CORRECTED FOR FIELD RECOVERY AS APPROPRIATE
PREDICTED DFR VALUES CALCULATED USING SEMILOG REGRESSION DATA

LINEAR REGRESSION DATA				
	CA GROUND	CA AERIAL	MS GROUND 1	MS GROUND 2
CONSTANT	4.513567	4.484742	3.80721	4.347296
X COEFF.	-0.194679	-0.255212	-0.260666	-0.363737
CORR. COEF.	0.941	0.882	0.881	0.964

SAMPLING INTERVAL (DAYS)	PREDICTED DFR VALUES (ug/50 g COTTON)				PREDICTED FOR ALL SITES		
	CA GROUND	CA AERIAL	MS GROUND 1	MS GROUND 2	MEAN	STD. DEV.	C.V.
0	91.2467	88.6541	45.0246	77.2692	75.5487	18.39	24.34
1	75.1051	68.6849	34.6932	53.7078	58.0478	15.56	26.80
2	61.8189	53.2138	26.7324	37.3309	44.7740	13.63	30.43
3	50.8831	41.2275	20.5984	25.9478	34.6642	12.04	34.74
4	41.8818	31.9411	15.8718	18.0356	26.9326	10.61	39.38
5	34.4728	24.7464	12.2299	12.5361	20.9963	9.28	44.17
6	28.3746	19.1724	9.4236	8.7135	16.4210	8.04	48.99
7	23.3551	14.8538	7.2612	6.0565	12.8817	6.92	53.75
8	19.2235	11.5080	5.5950	4.2097	10.1341	5.92	58.42
9	15.8229	8.9159	4.3112	2.9261	7.9940	5.03	62.98
10	13.0238	6.9076	3.3219	2.0338	6.3218	4.26	67.41
11	10.7199	5.3517	2.5597	1.4137	5.0112	3.59	71.71
12	8.8235	4.1462	1.9723	0.9826	3.9812	3.02	75.88
13	7.2626	3.2123	1.5198	0.6830	3.1694	2.53	79.91
14	5.9779	2.4887	1.1710	0.4747	2.5281	2.12	83.82
15	4.9204	1.9282	0.9023	0.3300	2.0202	1.77	87.60
16	4.0499	1.4938	0.6953	0.2294	1.6171	1.48	91.25
17	3.3335	1.1574	0.5357	0.1594	1.2965	1.23	94.78
18	2.7438	0.8967	0.4128	0.1108	1.0410	1.02	98.20
19	2.2584	0.6947	0.3181	0.0770	0.8371	0.85	101.50
20	1.8589	0.5382	0.2451	0.0535	0.6739	0.71	104.70
21	1.5301	0.4170	0.1889	0.0372	0.5433	0.59	107.78
22	1.2594	0.3231	0.1455	0.0259	0.4385	0.49	110.76
23	1.0366	0.2503	0.1121	0.0180	0.3543	0.40	113.63
24	0.8532	0.1939	0.0864	0.0125	0.2865	0.33	116.40
25	0.7023	0.1502	0.0666	0.0087	0.2319	0.28	119.07
26	0.5781	0.1164	0.0513	0.0060	0.1879	0.23	121.64
27	0.4758	0.0902	0.0395	0.0042	0.1524	0.19	124.12
28	0.3916	0.0699	0.0305	0.0029	0.1237	0.16	126.50
29	0.3223	0.0541	0.0235	0.0020	0.1005	0.13	128.78
30	0.2653	0.0419	0.0181	0.0014	0.0817	0.11	130.98

$(e \char`\^ ((X\ COEFFICIENT * INTERVAL\ (days)) + CONSTANT))$

TRIBUPHOS ON COTTON/TRANSFER COEFFICIENT AND REGRESSION CALCULATIONS
VERSAR, INC.
JLD 1/28/97
SAMPLE MATRIX: COTTON BOLLS WASHED IN DISLODGING SOLUTION
ALL EXPOSURE AND DFR DATA ARE FROM THE CA AERIAL & GROUND APPLICATION SITES
RESIDUE LEVELS CORRECTED FOR FIELD RECOVERY AS APPROPRIATE

STUDY SITE	SAMPLE INTERVAL (DAT)	ACTUAL DFR (ug/50 g)	PREDICTED DFR (ug/50 g)	AVERAGE DERMAL EXPOSURES BY JOB FUNCTION (ug/hr)			
				PICKERS	MODULE	RAKERS	TRAMPERS
CA AERIAL	15	2.38	1.93	85.33	79.33	130.00	NO DATA
CA AERIAL	17	6.08	1.16	137.00	NO DATA	413.00	246.25
CA GROUND	20	2.78	1.86	212.75	20.67	53.33	NO DATA

STUDY SITE	SAMPLE INTERVAL (DAT)	TRANSFER COEFFICIENTS USING ACTUAL DFR (50 g/hr)			
		PICKERS	MODULE	RAKERS	TRAMPERS
CA AERIAL	15	35.85	33.33	54.62	NO DATA
CA AERIAL	17	22.53	NO DATA	67.93	40.50
CA GROUND	20	76.53	7.44	19.18	NO DATA
	MEAN	44.97	20.38	47.24	N/A

STUDY SITE	SAMPLE INTERVAL (DAT)	TRANSFER COEFFICIENTS USING PREDICTED DFR (50 g/hr)			
		PICKERS	MODULE	RAKERS	TRAMPERS
CA AERIAL	15	44.25	41.14	67.42	NO DATA
CA AERIAL	17	118.37	NO DATA	356.83	212.76
CA GROUND	20	114.44	11.12	28.69	NO DATA
	MEAN	92.36	26.13	150.98	N/A

TRANSFER COEFFICIENT CALCULATED USING: EXPOSURE (ug/hr)/DFR (ug/50 g COTTON)

13544

R119973

Chemical: Tribuphos

PC Code:
074801
HED File Code: 12000 Exposure Reviews
Memo Date: 1/29/1997
File ID:
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